

Appln No. 09/892,010
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Reply to Office action of April 15, 2005

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A method of encoding a video stream, the method comprising the steps of:

receiving the video stream;

generating a base bitstream comprising one or more base video object planes (VOPs) using the video stream, each base VOP being associated with a base presentation time stamp (PTS) and a base decoding time stamp (DTS);

generating a first enhancement bitstream comprising one or more first enhancement VOPs using the video stream, each first enhancement VOP being associated with a corresponding base VOP, a first DTS and a first PTS,

wherein the first DTS and the first PTS associated with each first enhancement VOP are selected to be equal to one another, the first PTS associated with each first enhancement VOP is selected to be equal to the base PTS associated with its corresponding base VOP, and the first DTS associated with each first enhancement VOP is selected to be equal to the base DTS associated with one of the base VOPs; and

generating a second enhancement bitstream comprising one or more second enhancement VOPs using the video stream, wherein each second enhancement VOP is associated with two corresponding base VOPs, a second DTS and a second PTS,

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wherein the second DTS and the second PTS associated with each second enhancement VOP are selected to be equal to one another, and

wherein the second enhancement bitstream comprises a temporal enhancement bitstream and the second enhancement VOPs comprise temporal enhancement VOPs.

2. (Canceled)

3. (Previously Presented) The method of encoding the video stream according to claim 1, wherein the first DTS is selected to be different from any of the second DTSSs.

4. (Currently Amended) The method of encoding the video stream according to claim 3, wherein the second DTS associated with each second enhancement VOP represents an interval that is right after ~~the~~ a later of ~~the~~ two intervals represented by the two base DTSSs associated with its two corresponding base VOPs.

5. (Currently Amended) The method of encoding the video stream according to claim 1, wherein each of the encoding generation of the base bitstream, the generation of the first enhancement bitstream and the generation of the second enhancement bitstream comprises MPEG-4 encoding.

6. (Currently Amended) The method of encoding the video stream according to claim 1, wherein each of the encoding generation of the base bitstream, the generation of the first

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enhancement bitstream and the generation of the second enhancement bitstream comprises fine granularity scalability (FGS) encoding.

7. (Currently Amended) The method of encoding the video stream according to claim 6, wherein the first enhancement bitstream comprises an FGS bitstream and the first enhancement VOPs comprise FGS VOPs.

8. (Currently Amended) The method of encoding the video stream according to claim 7, wherein the second enhancement bitstream comprises an FGS temporal scalability (FGST) bitstream and the second enhancement VOPs comprise FGST VOPs.

9. (Previously Presented) The method of encoding the video stream according to claim 1, the method further comprising the step of combining the first and second enhancement bitstreams to generate a single enhancement bitstream.

10. (Original) The method of encoding the video stream according to claim 1, the method further comprising the steps of packetizing the base bitstream and the first enhancement bitstream, and multiplexing the packetized bitstreams to generate a transport stream.

11. (Currently Amended) A method of decoding a multiplexed bitstream to generate a video stream, the method comprising the steps of:

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receiving the multiplexed bitstream;
demultiplexing and depacketizing the multiplexed bitstream to generate a base bitstream and a first enhancement bitstream;

decoding the base bitstream to generate one or more base video object planes (VOPs), each base VOP being associated with a base presentation time stamp (PTS) and a base decoding time stamp (DTS);

decoding the first enhancement bitstream to generate one or more first enhancement VOPs, each first enhancement VOP being associated with a corresponding base VOP, a first DTS and a first PTS; and

presenting the first enhancement VOPs and the base VOPs to be displayed,

wherein each first enhancement VOP is decoded and presented at ~~the~~ a same time unit, and wherein each first enhancement VOP and its corresponding base VOP are presented at the same time unit,

wherein the demultiplexing and depacketizing step further generates a second enhancement bitstream, the method further comprising the step of decoding the second enhancement bitstream to generate one or more second enhancement VOPs,

wherein each second enhancement VOP is associated with two corresponding base VOPs, a second DTS and a second PTS,

wherein each second enhancement VOP is decoded and presented at ~~the same~~ a common time unit, ~~and~~

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wherein the second enhancement bitstream comprises a temporal enhancement bitstream and the second enhancement VOPs comprise temporal enhancement ~~VOPs~~. VOPs,

wherein the method further comprises using one or more frame buffers for storing partially decoded data of the base bitstream and of the first enhancement bitstream, and

wherein not more than a total of three frame buffers are used simultaneously for decoding the base bitstream, the first enhancement bitstream and the second enhancement bitstream and presenting the decoded bitstreams.

12. (Canceled)

13. (Currently Amended) The method of decoding the multiplexed bitstream according to claim 11, wherein each second enhancement VOP is decoded right after ~~the~~ a sequential second of the two corresponding base VOPs has been decoded, unless this would cause the second enhancement VOPs to be decoded out of display order, in which case, the second enhancement VOPs are decoded in the display order.

14. (Currently Amended) The method of decoding the multiplexed bitstream according to claim 11 wherein the decoding of the multiplexed bitstream comprises MPEG-4 decoding.

15. (Currently Amended) The method of decoding the multiplexed bitstream according to claim 11, wherein the

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decoding of the multiplexed bitstream comprises fine granularity scalability (FGS) decoding.

16. (Currently Amended) The method of decoding the multiplexed bitstream according to claim 15, wherein the first enhancement bitstream comprises an FGS bitstream and the first enhancement VOPs comprise FGS VOPs.

17. (Currently Amended) The method of decoding the multiplexed bitstream according to claim 16, wherein the second enhancement bitstream comprises an FGS temporal scalability (FGST) bitstream and the second enhancement VOPs comprise FGST VOPs.

18. (Original) The method of decoding the multiplexed bitstream according to claim 11, wherein the multiplexed bitstream is an MPEG-4 Transport stream.

19. (Currently Amended) A video encoding system for generating a base bitstream and one or more enhancement bitstreams using a video stream, the video encoding system comprising:

a base encoder for receiving the video stream and for generating the base bitstream using the video stream, the base bitstream comprising one or more base video object planes (VOPs);

an enhancement encoder for receiving processed video data from the base encoder and for generating a first

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enhancement bitstream using the processed video data, the first enhancement bitstream comprising one or more first enhancement VOPs, each first enhancement VOP being associated with a corresponding base VOP; and

a multiplexer for time stamping each base VOP with a base decoding time stamp (DTS) and a base presentation time stamp (PTS), for time stamping each first enhancement VOP with a first DTS and a first PTS, for packetizing the base bitstream and the first enhancement bitstream into packets, and for multiplexing the packets to generate a multiplexed bitstream,

wherein the first DTS and the first PTS associated with each first enhancement VOP are selected to be equal to one another, the first PTS associated with each first enhancement VOP is selected to be equal to the base PTS associated with its corresponding base VOP, and the first DTS associated with each first enhancement VOP is selected to be equal to the base DTS associated with one of the base VOPs,

wherein the enhancement encoder further generates a second enhancement bitstream using the processed video data, the second enhancement bitstream comprises one or more second enhancement VOPs, and each second enhancement VOP is associated with two corresponding base VOPs,

wherein the multiplexer time stamps each second enhancement VOP with a second DTS and a second PTS, packetizes the second enhancement bitstream into second packets, and multiplexes the second packets with the packets for the base bitstream and the first enhancement bitstream to generate the multiplexed bitstream,

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wherein the second DTS and the second PTS associated with each second enhancement VOP are selected to be equal to one another, and

wherein the second enhancement bitstream comprises a temporal enhancement bitstream and the second enhancement VOPs comprise temporal enhancement VOPs.

20. (Canceled)

21. (Previously Presented) The video encoding system according to claim 19, wherein the first DTS is selected to be different from any of the second DTSSs.

22. (Currently Amended) The video encoding system according to claim 21, wherein the second DTS associated with each second enhancement VOP represents an interval that is right after ~~the~~ a later of ~~the~~ two intervals represented by the two base DTSSs associated with its two corresponding base VOPs.

23. (Currently Amended) The video encoding system according to claim 19, wherein the ~~encoding~~ generation of the base bitstream and the one or more enhancement bitstreams comprises MPEG-4 encoding, and the multiplexed bitstream is an MPEG-4 Transport stream.

24. (Currently Amended) The video encoding system according to claim 19, wherein the ~~encoding~~ generation of the

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base bitstream and the one or more enhancement bitstreams
comprises fine granularity scalability (FGS) encoding.

25. (Currently Amended) The video encoding system according to claim 24, wherein the first enhancement bitstream comprises an FGS bitstream and the first enhancement VOPs comprise FGS VOPs.

26. (Currently Amended) The video encoding system according to claim 25, wherein the second enhancement bitstream comprises an FGS temporal scalability (FGST) bitstream and the second enhancement VOPs comprise FGST VOPs.

27. (Previously Presented) The video encoding system according to claim 19, wherein the first and second enhancement bitstreams are combined to generate a single enhancement bitstream.

28. (Currently Amended) The video encoding system according to claim 19, wherein each VOP ~~comprise~~ comprises a plurality of bit planes.

29. (Currently Amended) The video encoding system according to claim 19, wherein the base encoder performs discrete cosine transform (DCT) on the video stream to generate DCT coefficients, and wherein the DCT coefficients are provided ~~as~~ in the processed video data to the enhancement encoder.

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30. (Currently Amended) A video decoding system for generating a base layer video and an enhancement video using a multiplexed bitstream, the video decoding system comprising:

a demultiplexer for demultiplexing and depacketizing the multiplexed bitstream to generate a base bitstream and a first enhancement bitstream;

a base decoder for decoding the base bitstream to generate one or more base video object planes (VOPs), each base VOP being associated with a base presentation time stamp (PTS) and a base decoding time stamp (DTS); and

an enhancement decoder for decoding the first enhancement bitstream to generate one or more first enhancement VOPs, each first enhancement VOP being associated with a corresponding base VOP, a first DTS and a first PTS,

wherein each first enhancement VOP is decoded and presented at ~~the~~ a same time unit, and wherein each first enhancement VOP and its corresponding base VOP are presented at the same time unit,

wherein the demultiplexer further generates a second enhancement bitstream, and the enhancement decoder further decodes the second enhancement bitstream to generate one or more second enhancement VOPs,

wherein each second enhancement VOP is associated with two corresponding base VOPs, a second DTS and a second PTS,

wherein each second enhancement VOP is decoded and presented at ~~the same~~ a common time unit, ~~and~~

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wherein the second enhancement bitstream comprises a temporal enhancement bitstream and the second enhancement VOPs comprise temporal enhancement ~~VOPs~~, VOPs,

wherein the base decoder comprises one or more frame buffers for storing partially decoded data of the base bitstream and the enhancement decoder comprises one or more frame buffers for storing partially decoded data of the first enhancement bitstream, and

wherein not more than a total of three frame buffers are used simultaneously for decoding the base bitstream, the first enhancement bitstream and the second enhancement bitstream and for presenting the decoded bitstreams.

31. (Canceled)

32. (Currently Amended) The video decoding system according to claim 30, wherein each second enhancement VOP is decoded right after—the a sequential second of the two corresponding base VOPs has been decoded, unless this would cause the second enhancement VOPs to be decoded out of display order, in which case, the second enhancement VOPs are decoded in the display order.

33. (Canceled)

34. (Currently Amended) The video decoding system according to claim 30 wherein the decoding at the base decoder

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and the decoding at the enhancement decoder ~~comprises~~ comprise
MPEG-4 decoding.

35. (Currently Amended) The video decoding system according to claim 30, wherein the decoding at the base decoder and the decoding at the enhancement decoder ~~comprises~~ comprise fine granularity scalability (FGS) decoding.

36. (Currently Amended) The video decoding system according to claim 35, wherein the first enhancement bitstream comprises an FGS bitstream and the first enhancement VOPs comprise FGS VOPs.

37. (Currently Amended) The video decoding system according to claim 36, wherein the second enhancement bitstream comprises an FGS temporal scalability (FGST) bitstream and the second enhancement VOPs comprise FGST VOPs.

38. (Original) The video decoding system according to claim 30, wherein the multiplexed bitstream is an MPEG-4 Transport stream.